

Sequencing
to Station
in 12 months
(targeting Orbital 5
launch, March 30th)



The Class 1E Process

- Science to Station more quickly
- New class of hardware to be called Experiment Flight Hardware, or Class 1-E
 - “Don’t hurt the crew”
 - “Don’t hurt the station”
- **Tech demo**, payload, and hardware on the space station



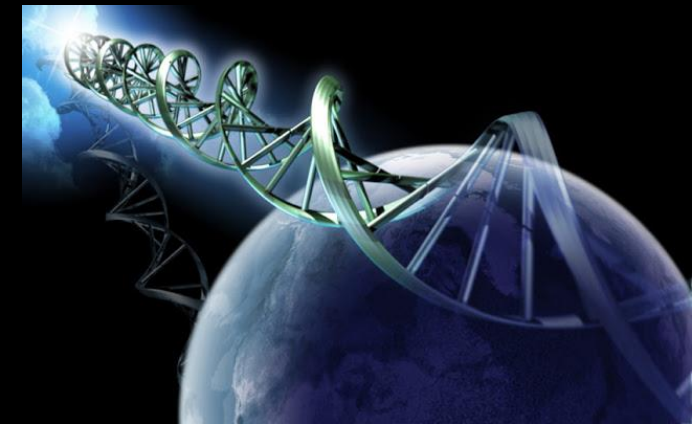
Class 1E Implementation

- MinION is a technology demonstration project
- Primary Objective: Test a small COTS DNA sequencer in microgravity on ISS
- Secondary Objectives
 - Test, refine and report on the use of the Class 1E process
 - Form a partnership of engineers and scientists using the ISS as an exploration laboratory
 - Future opportunities for MinION/sequencing

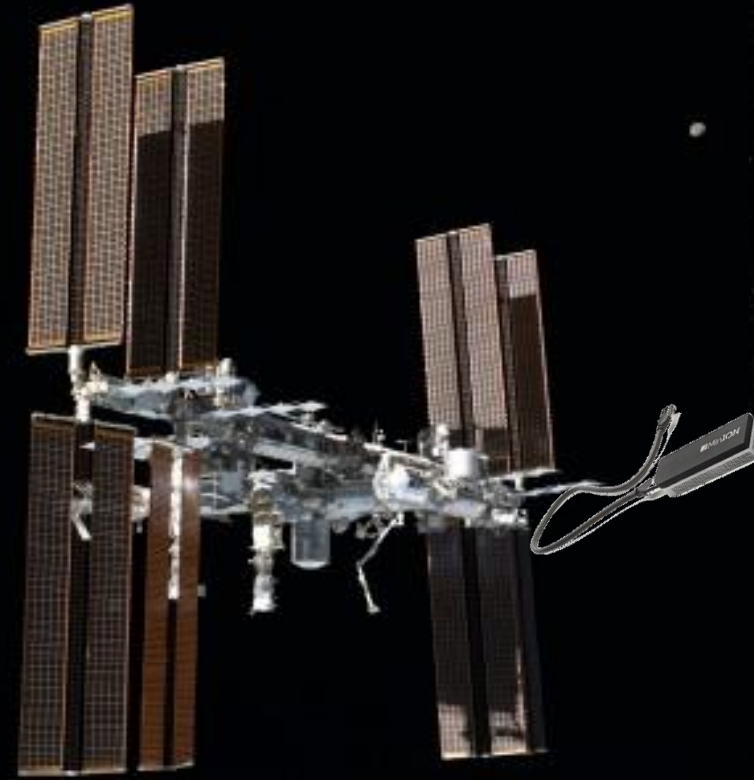


DNA Sequencing: Benefits

- Benefits to In-flight Sequencing
 - Sequencing on the ISS can inform real-time decisions (research, med ops, etc.)
 - Unlike other technologies, sequencing is not limited to the detection of targets, but rather will provide data on the entirety of a sample
 - Reduce down mass (sample return for environmental monitoring, crew health, etc.)
 - Real-time analysis can influence medical intervention
 - Support in-situ science investigations
 - Technology superiorly suited to astrobiology / search for life investigations



Biomolecule Sequencer: Concept of Operations



4. Destow and connect MinION to Surface Pro3



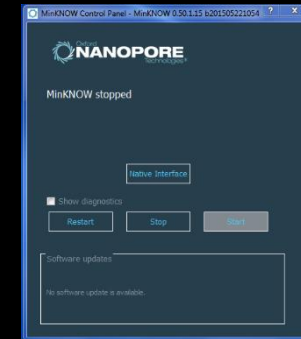
5. Sample injection



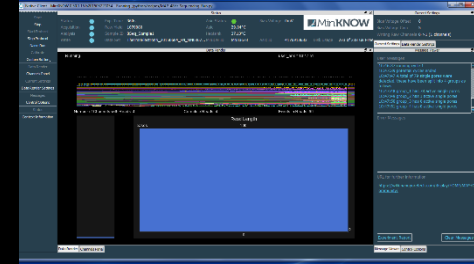
6. Dispose of sample syringe



7. Initiate the sequencing experiment



8. Data collection

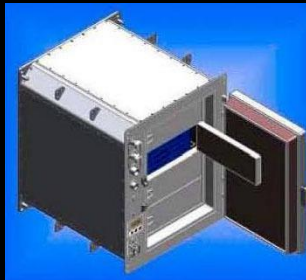


Sequencing stops after 48 hrs

3. Remove flow cells and sample syringes from cold stowage and allow to equilibrate to room temperature



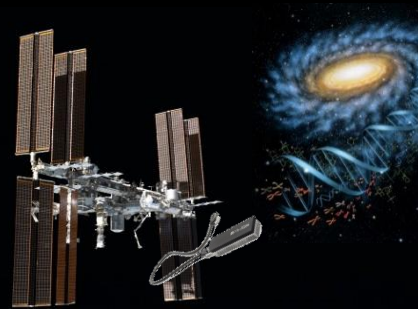
2. Stowage
(Ambient, -90°C, + 4°C)



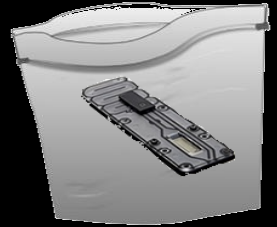
1. Launch packaged items



The first DNA Sequencer in Space!



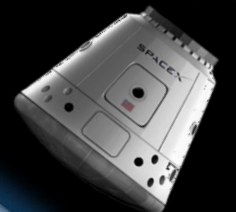
9. Stow used flow cell for return



10. Data downlink

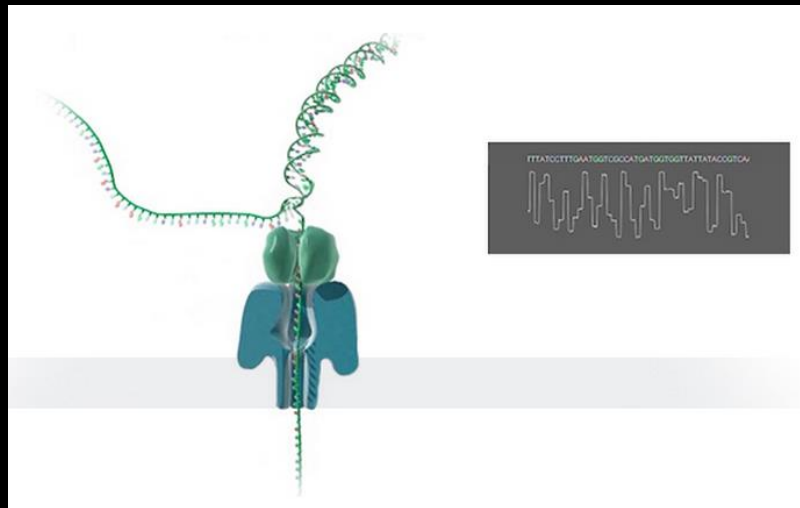
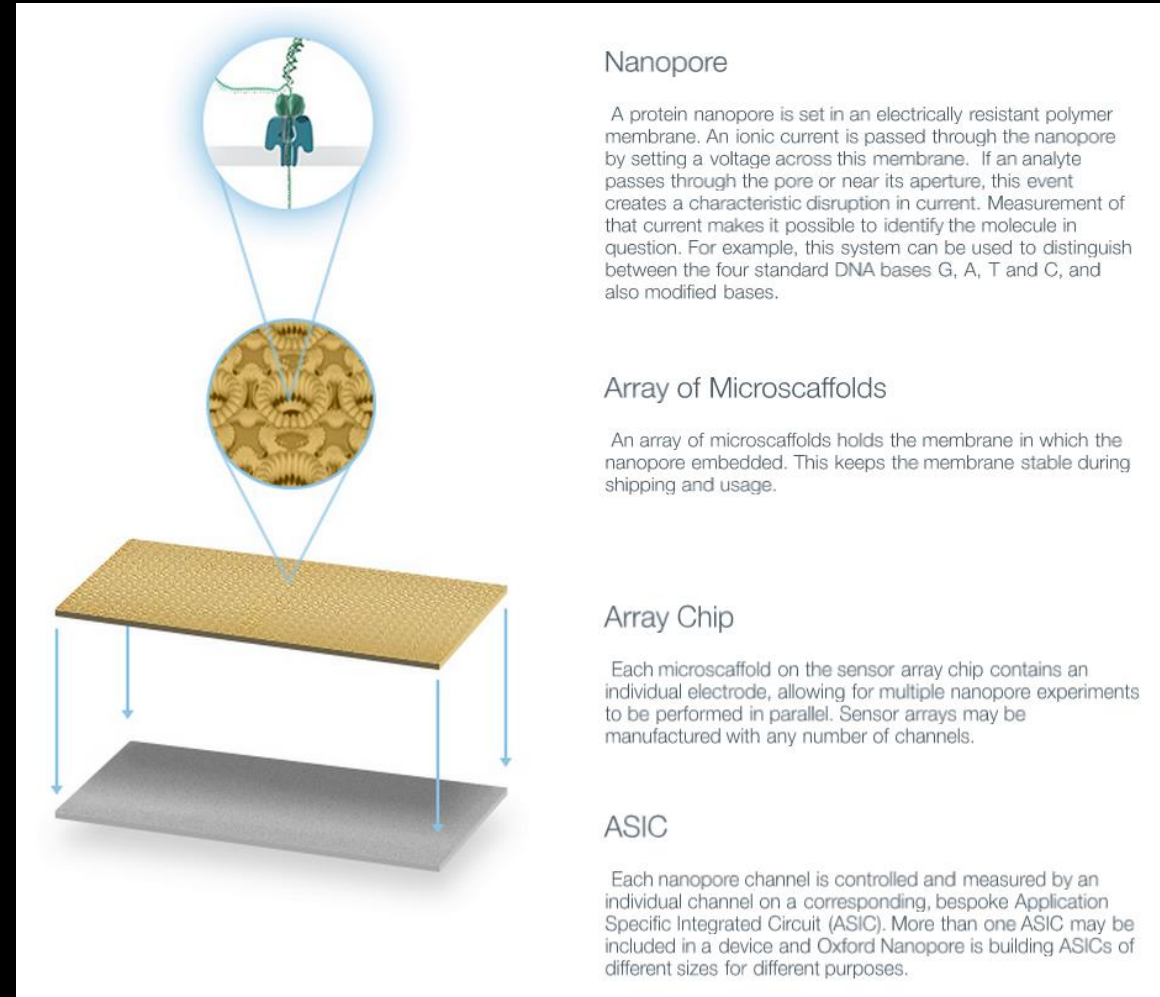
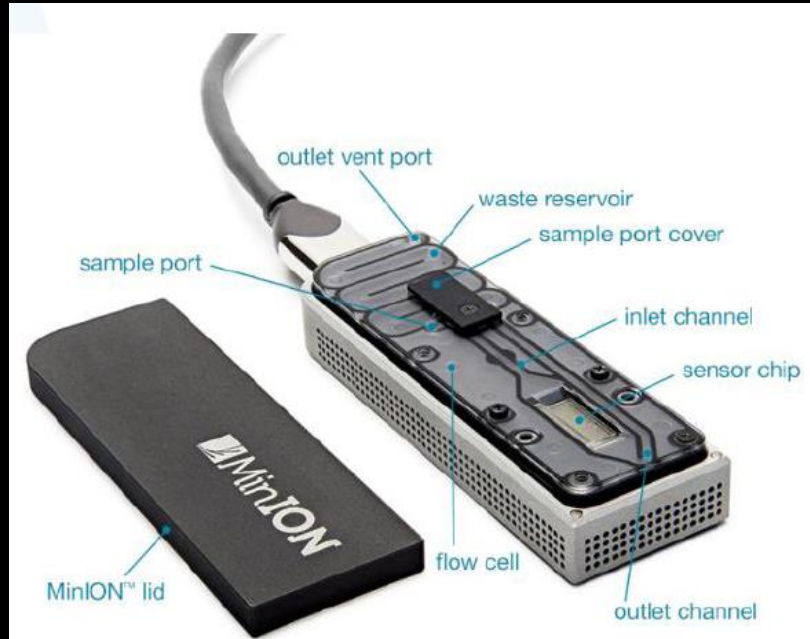


11. Stow MinION, Surface Pro3 and associated power & USB cords



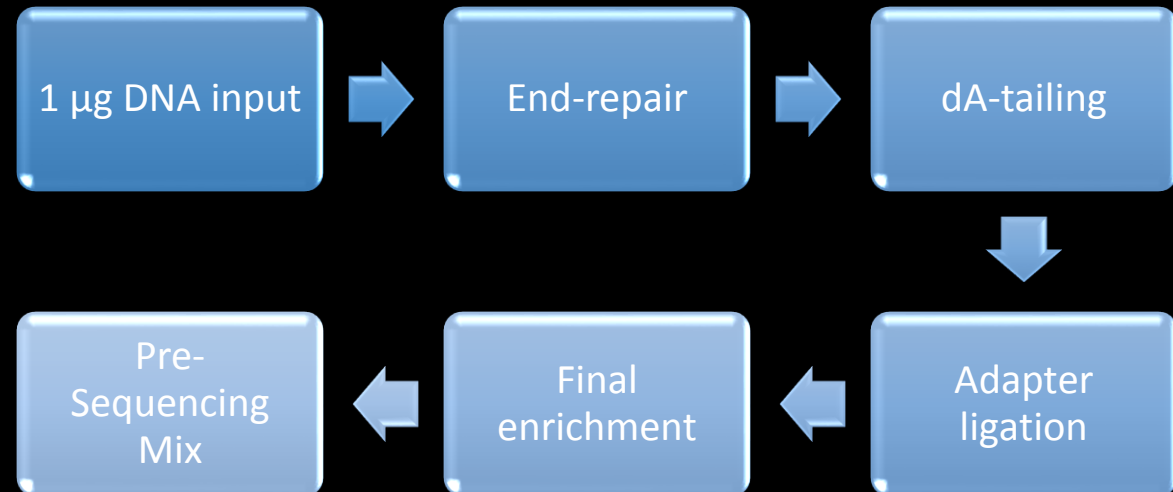
12. Return of payload

Nanopore sequencing



MinION Sample Prep Workflow

- Prep time ~4 hours
- Requires molecular biology laboratory and trained personnel
- Loading of flow cell ~30 minutes with multiple pipetting steps
- Manual preparation of DNA not currently feasible in microgravity



Sample to be sequenced

- Virus – lambda bacteriophage
- Bacterium – *E. coli* genomic DNA
- Mammal – Mouse genomic DNA



Forward work and opportunities for collaboration

- Biomolecule Sequencer is a tech demonstration on ground-prepared samples
- Have a need or potential need for in-flight:
 - DNA extraction
 - DNA amplification
 - Sequencing library preparation
 - Researchers with projects that require or could benefit sequencing

